

CI226444

Get Organized Civil Infrastructure Projects

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Description

Building Information Modeling (BIM) Data Management

Speaker(s)

Cees Kruit

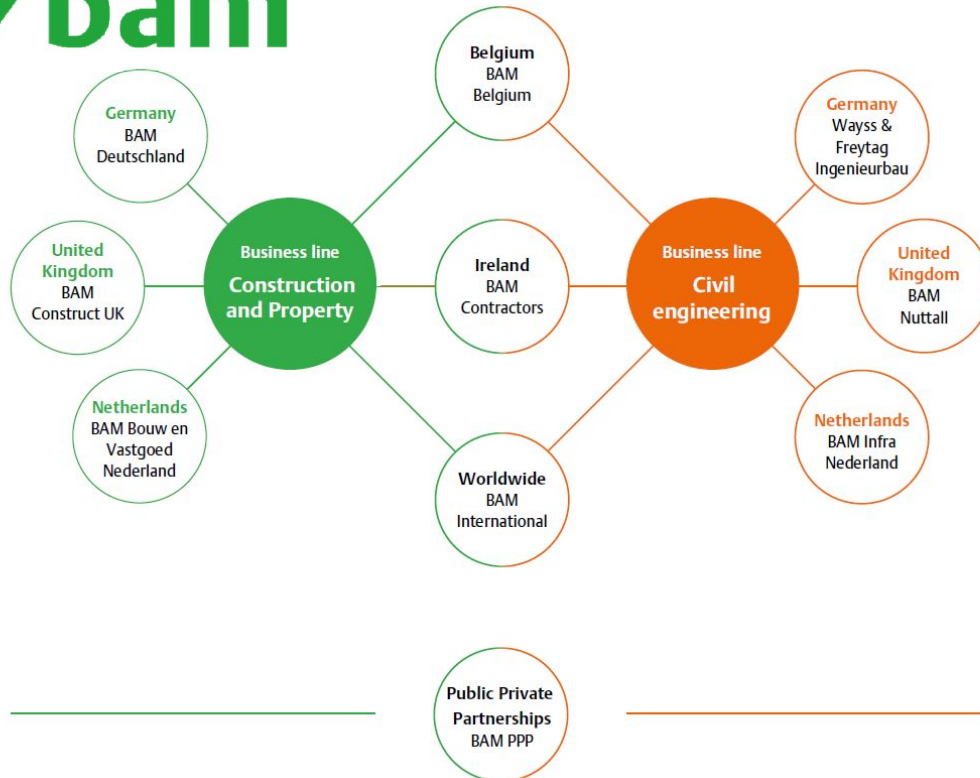
Start my carrier at BAM since 1989 as a Draftsman with a CADAM Mainframe system. A lot of projects past in only 2D drafting work. I started working with 3D since 1994. During the years I have expanded my experience with various Autodesk products as well as from other suppliers. In 2014 I started as a BIM coordinator at the largest lock in the world near Amsterdam. Here I have been able to use all experience gained with the various software and gave me a lot of support to share the knowledge. I have now been able to continue my acquired knowledge in 2 new large projects, Lock near Terneuzen (South West of Netherlands) and reconstruction of a 26km long enclosing embankment and use points for improvement.

Frank Pepping

Frank Pepping is Consultant at CAD & Company. For the past seven years, Frank has advised and implemented engineering data management solutions for large scale civil infrastructure projects. He uses AEC Autodesk software in profession for over 13 years and started using Autodesk software with AutoCAD® Release 14, almost 20 years ago. Frank has a bachelor's degree in building construction.

Royal BAM

Royal BAM is an international operating Construction company.



Organization of Royal BAM

BAM group has 10 Operating Companies spread-out over 40 countries and has about 20.000 employees Worldwide. BAM Infra the Dutch company with the consulting part BAM Infraconsult. BAM Infraconsult has about 450 employees. BAM Infraconsult's department CAD&BIM services has about 40 employees which are: BIM-modelers, BIM specialists, BIM-coordinators, BIM Managers and Artists for visualizations, AR and VR. These people give support at all kind of projects in the Netherlands and abroad. With a large variety of expertise like; Bridges, Tunnels, Jetties, Locks, Garages, Buildings, On shore and Offshore structures, etc.

CAD & COMPANY

CAD & Company

CAD & Company is part of the CAD & Company Group. CAD & Company is a Value-Added Reseller and three times rewarded with an Autodesk Platinum award in the last three years. We were the first Forge System integrated. Our BLDNG360 platform is the most used Forge enabled platform worldwide. We support the AEC and Manufacturing customers with CAD-support and supporting the company's IT infrastructure as well with our IT department. On-premise and in the Cloud. We have 60 proud colleges supporting our client needs.

Objectives:

1. Learn about managing engineering and construction data
2. Learn how to pick the right solution for your projects needs
3. Learn what brings the cloud to civil infrastructure projects
4. Learn how to maintain the BIM execution plan

Content

Introduction

- *Project*
 - Facts and numbers
 - Issues to solve
 - Used Software to control
 - Implement Existing CAD-data during Design Phase
 - The Change
 - Only File managing

Goal

- Get (in) control on the large amount of different Files

Get the project into Vault

- *Checking before import into Vault*
- *Who is in Control?*
 - Learning how to use Vault with different software
 - *Unique file naming*
 - *Versions and Revisions*
 - *(Just) Numbers*
- *Subcontractors*

Conclusion

- *Lessons learned*
 - BIM Execution Plan
 - Revit and Vault
 - Civil3D and Vault
 - Inventor and Vault
 - Navisworks and Vault
 - Other Supplier software and Vault
- *Tips & Tricks*
 - Start Vault before start Design Phase
 - How do we get new users instructed?
- *Summary*
 - How to setup projects now?

Introduction

The Project

In this Class the Largest Lock in the World, called Openij, will be the example off the case we are talking about.



Impression Lock at Port of Amsterdam

Why does Amsterdam need a new and larger Lock?

Amsterdam would like to have larger Cruise ships and its tourists. One of the largest Cruise ships, Symphony of the Sea, can't pass the existing Northern Lock. In the future larger Cruise ships will be made. But also, the industry near Amsterdam likes to receive larger vessels and cargo for their industry. Additional benefit is the increase of the existing high-water level to a new level +8.85m above sea-level.

Numbers

Tender started in 2014. After 1 year, Openij won this tender and was able to start the design phase. The Lock has a length of 545m (nominal 500m) between the doors, 70m wide and is 18m deep. The lock has 2 operational doors and 1 spare door. All doors are 75m long, 25m high and 11.5m Thick. The doors are identical for use in the 2 operational places. This lock will be built by 3 Main Contractors (BAM, Volker Infra and van Oord) and a large count of subcontractors. This lock will be finished early starting 2022. After handover there will be a maintenance period of 26 years.

Issues to solve

A project of this size has needed a way of work that supports integrated design. Because many different disciplines must work closely together. Its A complex case where A new lock will be built between two existing locks in the North Sea coast. The collaboration must express itself in a BIM model where all disciplines must be processed, so everything in 3D. To be able to deliver a good product, all disciplines must work in a disciplinary manner.

This must be recorded in a plan, the BIM execution plan. This is a very important document to make everyone aware that we work together on 1 product. With a large variety of software with different settings and possibilities and impossibilities, it is important to find unity for an optimal working method.

All this software generates a lot of (3D) data. When we started the design phase, we started to store the data on a network with a division into fixed folders.

Users are different in nature! Everyone wants to use their own method, which quickly creates chaos on the network with the creation of new folders and copies with different names.

All these files (>5,000) have no version, revision or relationships store in metadata when working like this way. You never know if you have the right relation/reference!

This gave us the need to structure this more and to place this in a Document management system.

The manager must be able to manage this and structure it better. We must regain control over the data.

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04 Richtlijnen

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09 Planning

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04 Richtlijnen

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Used Software to control



Used Software

As mentioned before, we use many different modeling software to eventually produce drawings. Established in the BIM execution plan we use Autodesk 2016 software (and others):

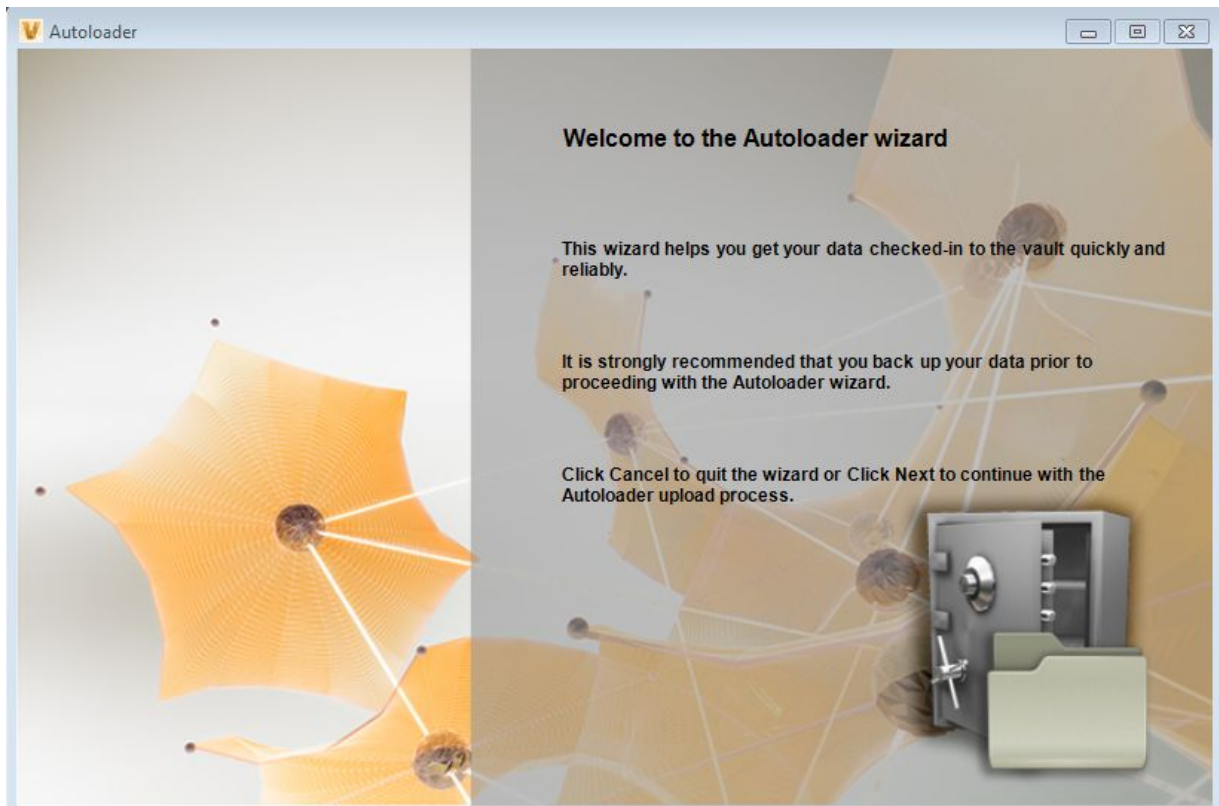
- Revit
 - o Structure (Concrete and Steel constructions)
 - o Architecture (Buildings)
 - o MEP (sewage system, drainage, Electrical parts and Equipment's)
- Inventor (Doors and movement works)
- AutoCAD (Additional drafting work, Phases)
- Civil3D (Temporary road design, final road design, Groundworks)
- Navisworks manage (Coordination models)
- 3D Max (Visuals)

Other used software:

- Allplan (3D Reinforcement)
- VOSS (river bottom works)
- SolidWorks (Steel Led Works)
- E-plan (Electrical plans, not 3D)

All this software must be controlled with a Document Management System.

Implement Existing CAD-data during Design Phase



Autodesk Autoloader

During the half-year design phase, we decided to switch from the file server to a document management system. This is not an easy step to take during a project in process. This must be well prepared and planned and the users must be trained in the changed way of work. At the same time, all data must be analyzed to be able to place this correctly in Vault. All references must be checked for proper linked references before putting them in Vault. We configured Vault to check on the use of unique file names. This caused some challenge with the many copies that had been made. The use of different software also has an impact on the conversion and import approach.

The Change

Working in combination of used software and Vault requires the necessary attention. Using data eVault requires structure and discipline. Most users are not used to this! They must change their old way of thinking. This is not a simple task. Some take this positive, but others ...

Revit

The Revit users were the easiest. Because we use Revit Central File system, this is easy to work with Vault. For Revit Central File you still need a network drive next to a Vault. From Revit you do not open from Vault because Vault cannot handle a Central File (Multi-user system). Nevertheless, the Central Files can be synchronized with Vault. This is a glorified backup system, but with established relationships. Vault also manages libraries. For Revit these are the Project Families. For the library you have to use the system of Vault, Check-in and Check-out. These are then opened from the Vault integration and can be imported into the project file in the usual way.

Currently we would advise to use BIM 360 Design Collaboration so Revit designers could work from any place and anywhere. Via a hybrid link the Revit model could be imported in Vault for getting milestone version registered in the single source of truth. Changes from other disciplines could be shared to the BIM 360 platform as well.

Inventor

Most of the Inventor users know how to work with Vault. Vault was once introduced in combination with Inventor. Vault later evolved to AEC environment and made integrations with other software. For Inventor files too, a check is needed to get them in Vault in a correct way. Certain files (files with settings) must be adjusted for use with Vault. This was done by an Inventor specialist because we lacked the knowledge. The way of working with Inventor and Vault has not brought many surprises with the users.

Civil3D

Unlike Inventor, it was a difficult step for Civil3D users. Structure is very important for Civil3D models. References, Alignments, Corridors, data links, etc. are very important for building a Civil 3D model.

When the data was analyzed, it turned out that there was a lot of error and had to be corrected before importing. This has caused the necessary turmoil among the users and a lot of time. An incorrect build-up of a Civil 3D model can take a lot of time in building the models in combination with Vault.

The new version of Civil3D and Vault, 2019, solved many problems with this combination.

AutoCAD

Because we did not use a lot of 2D AutoCAD this did not lead to many problems.

Navisworks

According to Autodesk reports, we were also able to import all Navisworks files (NWF, NWC and NWD) into Vault. In the Vault Pro 2016 version, however, this had no good consequences for the NWF files. Some NWC files had material files. Because these were in different NWC files

and Vault was set to Unique file names, we received error messages and we could not import this NWF. We decided not to import NWF-file into Vault. We must continue...
New version of Vault solved this problem.

Only File Managing

Although Vault can manage a lot, from File management to approval drawings and delivering management, we only used File Management. Why?

At the project we already using another DMS (ThinkProject) for other kind of documents. We didn't want to disturb a process and using familiar software to check and approve (CAD-)files. Secondly, we were not familiar to this software and like to start with the easiest part and don't make things to complicated for our users.

Making PDF prints of each drawing and uploading this to ThinkProject wasn't a wrong decision. With software from CAD&Company; AutoProperty and Publisher, PDF will be made in Background at the Vault Server. These PDF's can be taken from Vault and uploaded to ThinkProject for further process.

Goals

With a large amount of (expecting) files (>20,000) it's hard to manage this at a file-server. No revisions, no versions, no reference check, possibility checking double files, etc.

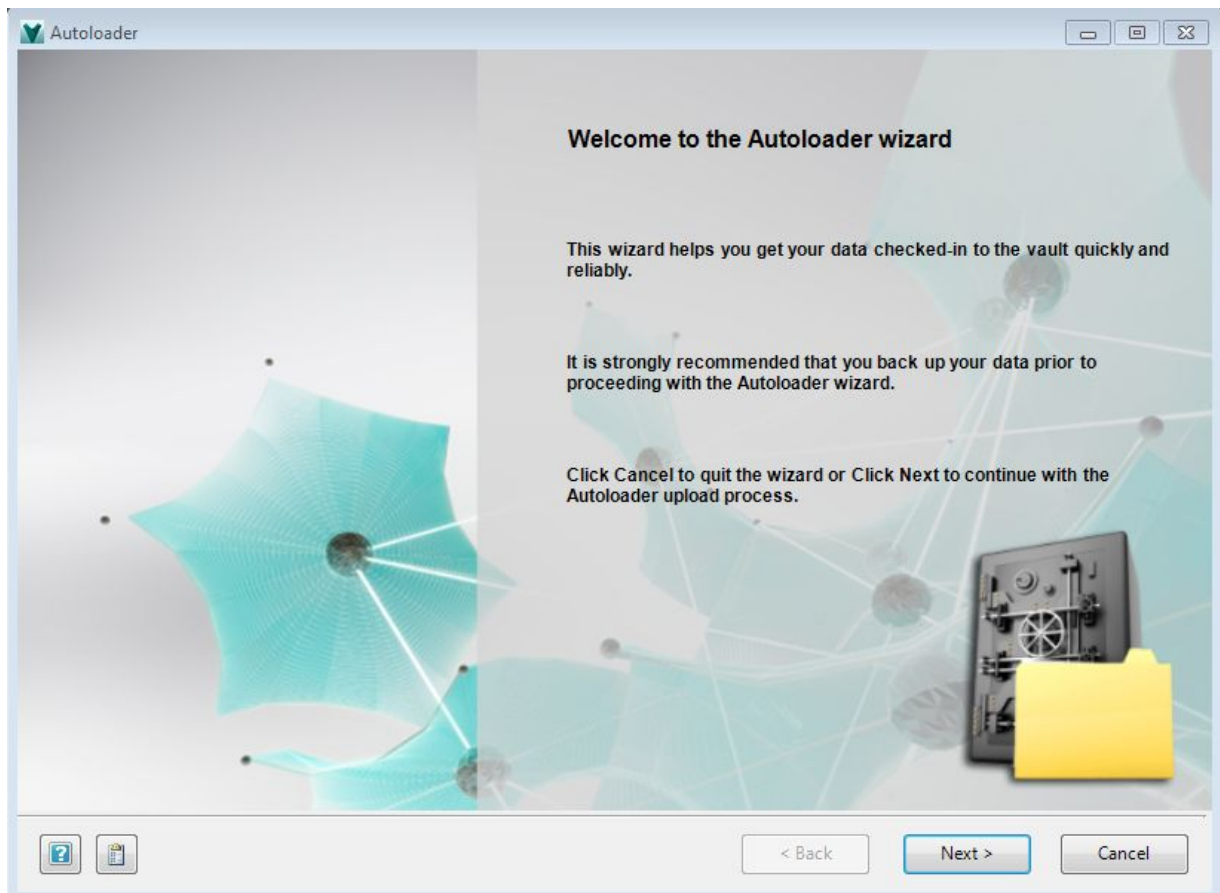
- The main goal is to get 'In Control' with all the files.
- Give users a good tool to work with and getting the right version of a reference file or other kind of files.
- To capture the correct structures of the CAD files so that we also have the right reference and can therefore also provide the correct information. Autodesk Autoloader has been an important tool for this. Now we can start from the right data in the right place.
- No more duplicate files at different locations
- Give access to Vault at other locations outside the office

Get the Project into Vault

Checking before import to Vault

When installing the Vault Client software, the integration at each Autodesk software will be installed too. With this integration you have an extra Tool bar with necessary tools to communicate with the Vault. You don't need to open Vault Client software while working with your Autodesk software at all.

Installing Vault Client, it will install Autoloader tool as well. This tool will help you checking different kind of file from selected folder. When done successfully the files can be uploaded to a selected folder in Vault. Notice that every type of file has a different approach.



Starting view AutoLoader

This approach must be started for any other software for the right import in Vault.

Revit

Revit Central Files are the easiest part. Revit Central File don't need the Autoloader tool. Using Central Files, you only have to open one project file and upload to the Vault by setting up the button to upload at synchronize.



What will happen now?

The Project file and all linked files will be uploaded to the vault. Depending on the size of these file it can take some time! The processing at the Vault server takes some time too and needs a lot of free storage on your drives. After the first start of synchronizing Revit files we had to increase the storage several times to get the models processed. Every time it was necessary to succeed with 100-250 Gb!

Working with Central File, you cannot use them direct from Vault. You need a separate Server for the Central File. In this case, Vault will only be a Back-up from the original Central File on the server. You can't check these files in or out! The only benefit you have is you have an extra Back-up with the whole tree of linked models and/or CAD files.

It is different for the Revit library. These must be checked and imported via the Autoloader tool. These are then treated as a library item.



A Project Family can/must be saved directly to Vault and can be used with the method of Vault (Check-in and Check-out).

Normally you open a family direct from your project-file. Now you first have to surge in Vault for the file and then check out the Family.

Make changes to the Family and upload to your project-file. To check-in the family, you "Save to Vault" and close the Family. Only closing the Family in Revit will check-in the file.

Civil3D

Civil 3D project that was firstly setup with Data Shortcuts can simply be imported into Vault within Civil 3D Tool space. Data Shortcuts will be transferred to c3ddate reference files that are associated with every file where de reference is used or created in. Think about, Alignments, profiles, corridors and other type of Data Shortcuts. The thing you need to be aware of is that all relevant and referenced files are in place and accessible.

Title blocks need to have logo's that are OLE object and not image references. Otherwise logo's will pop-up everywhere in the Vault. Fix that first.

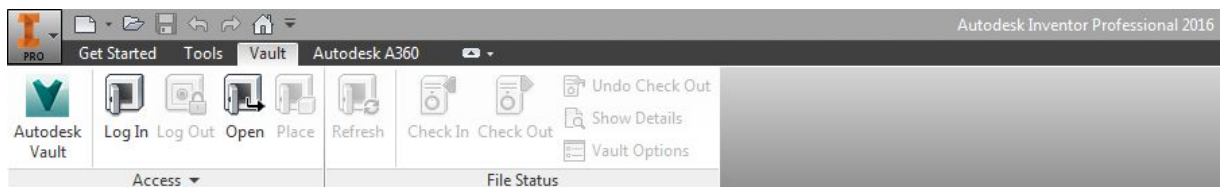
In order to get the correct metadata of the title block between Civil3D and Vault, the attributes / fields need to be linked in Vault. Only with this is a correct exchange possible.

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	Project: NL_META_PROJECTOMSCHRIJVING_1		
	Omschrijving: NL_META_TEKENINGOMSCHRIJVING_1 NL_META_TEKENINGOMSCHRIJVING_2 NL_META_TEKENINGOMSCHRIJVING_3		
		Schaal:	Opgesteld:
		Paraaf: NL_META_OPSTELLER Datum: DATUM_GET	
		Paraaf: NL_META_SCHAAAL2 Datum: DATUM_GET	
		Paraaf: NL_META_SCHAAAL3 Datum: DATUM_GET	
	TP-code:		
	Format:	Vrijgegeven:	Paraaf:
	NL_META_NIEUWBLADFORMISATOR		
Tekeningnummer:	NL_META_ID_NUMMER		
Platform: PLATFORM			
Status: NL_META_DOCUMENTSTATUS			
Datum:			
Deze tekening is gebaseerd op: \\vaultwsl-configuratie\templates\autocad\teckid\acad_mmd.dwg			

Title block with linked attributes (Fields)

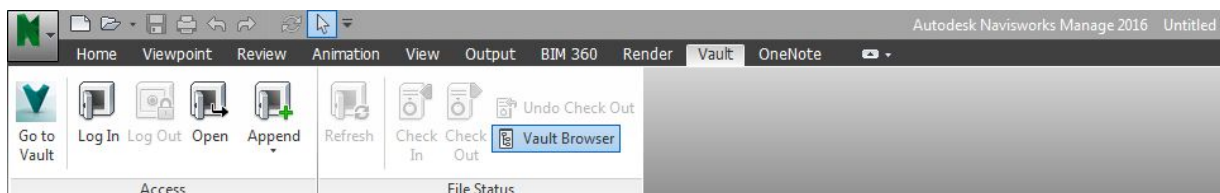
Try to avoid pay items in your Civil 3D template. If there is no need for QTO in Civil 3D, break the connection with pay item files.

Inventor



Inventor-files must be imported using the Autoloader tool of Autodesk to maintain file references. References will be checked before importing. The Inventor project-file must be set correctly and associated with Vault.

Navisworks



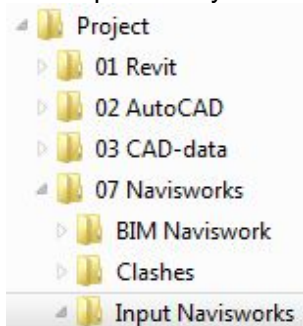
The NWC-files (cache-files) can be imported, only the first time, into Vault by simply Drag and Drop¹ at the right folder while this is checked out by importing with dedicated software. The NWF-file is a different story with Autodesk 2016 software. Depending on the Materials used at the NWC-files. Some NWC-files includes the same material¹.

The NWF-file has to be loaded into Vault by using the Vault tools from the Vault Tab in Navisworks. While uploading the NWF-file to Vault it registries the 'tree' of NWC-files including the materials. When Vault locates the same material(s) it gives you a notification 'Double files' and the file won't be uploaded to Vault. This message we communicated with Autodesk and hasn't been solved for Vault 2016².

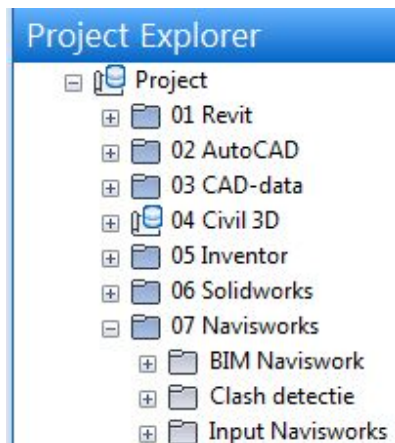
Therefor we had to store our NWF-file as a Zipped-file to Vault by Drag and Drop.

Updating the NWC file has a different approach.

Working with Vault and checking out one or more files this copies all the check-out file to a 'Workspace' on your local machine with the same folder structure as Vault.



Folder structure Windows Explorer



Folder structure Vault

After exporting NWC file(s) from Autodesk software you overwrite the checked out NWC files on your Local machine. At Vault you will notice the 'Checked-out' files as bolded shown file names. When right clicking on the specific file and click 'Check In', the new file will be overwritten in Vault and the version number will be increase to a next number.

¹ Since version 2019 Navisworks files are addressed as Design files and need to be checked-in via Navisworks.

² Issue is solved in Navisworks Manage 2018 and later.

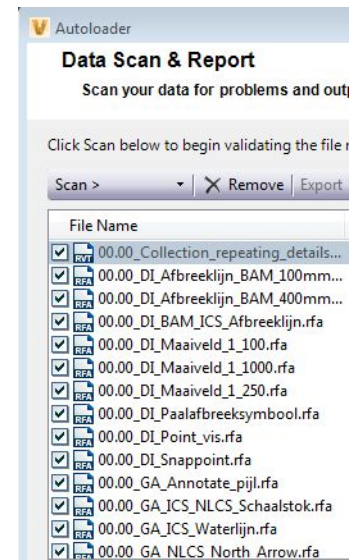
With the integration of Vault at Navisworks Manage will show that the NWC file has been updated since latest opening the NWF file.

Note: All NWC files must be linked via the Vault integration to get this way of working correctly.

Library

Inventor Content Center libraries are databases stored on the Vault database server. Used parts are stored in Vault and associated with the assemblies.

Vault can manage also libraries from other Autodesk software. All libraries must be uploaded by using the specific way of importing Library items with Autoloader from Autodesk. When managing Revit libraries do not load more than 1000 items per upload session. Otherwise Vault wont index Revit family types.



Autoloader Revit Families

Who is in Control

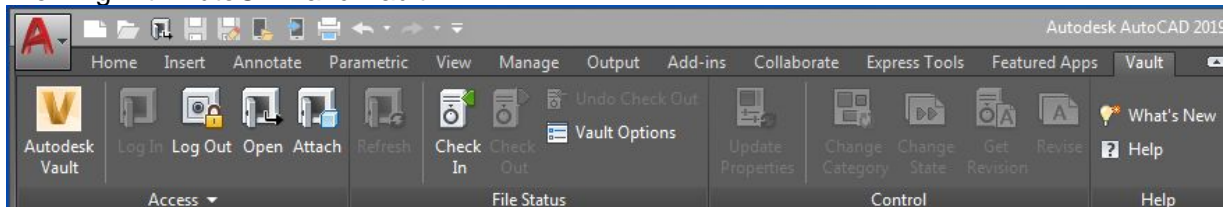
When all files can be accessed from Vault we have control on the files with versions, revisions and relations. At every Check-out and Check-in, we know who changed the file at what time and date. Each version of a file gets a history during check-out, check-in. With this history it's possible to get back to previous version and/or Revision at any time with all relations included. This take you in control every time and every moment.

Learning how to use Vault with different software

AutoCAD

Working with Vault you don't have to use Vault Client when an integration has been setup into the software. You can simply access Vault using the 'Vault Tab'. This is the most save way working with Vault.

Every Autodesk software has a different approach working with Vault. Most common is Working with AutoCAD and Vault.



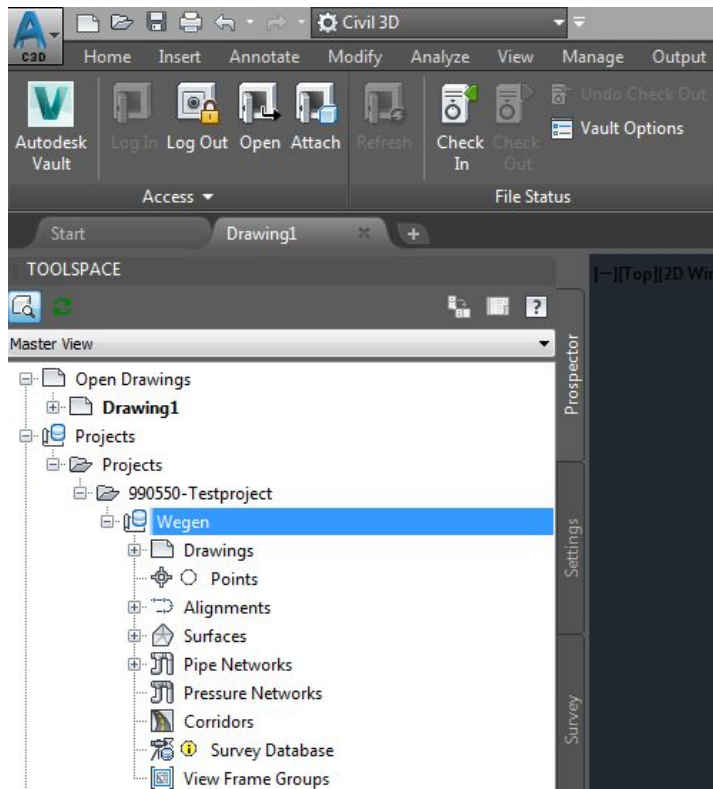
Vault Tab in AutoCAD/Civil3D

With 'Attach' you can make references direct from Vault.

Civil3D

Working with Civil3D needs some more attention. With Civil3D you need to work with the Toolspace. The Toolspace has 'Data Shortcuts' which has to be linked from Vault. When you are not using all right options and links from Vault, it can downgrade your performance a lot while syncing with Vault.

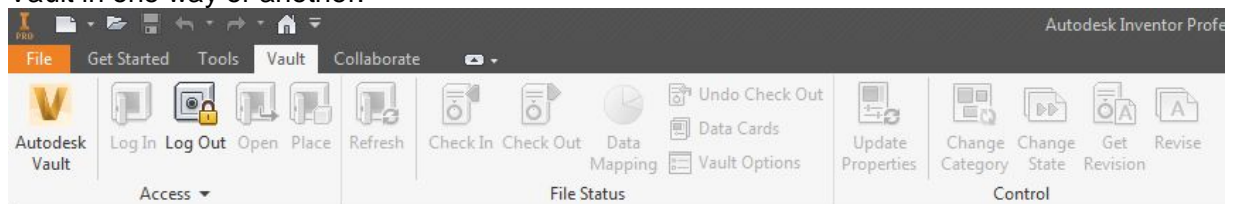
To setup your Civil3D model with all opportunities from Vault is the best way. This approach is different from the daily working method Civil3D designers uses.



Toolspace at Civil 3D

Inventor

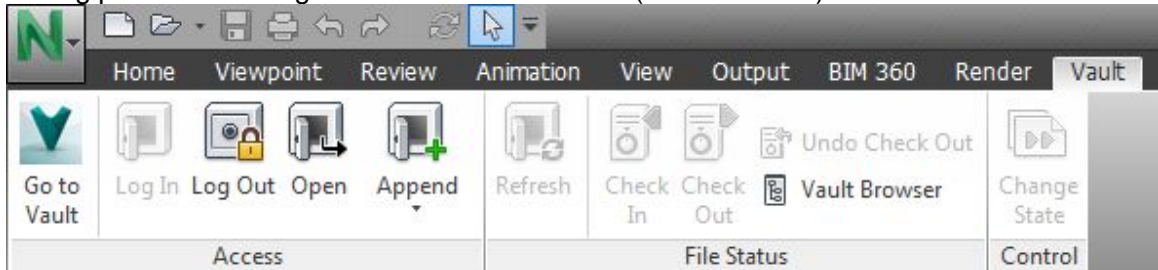
Originally Vault has started at the early years of Inventor. Models, Parts and library objects were managed from Vault. Not many users of Inventor used Vault Pro but used the standard Vault. The approach isn't much different. Users of Inventor are used to Vault in one way or another.



Vault Tab Inventor

Navisworks

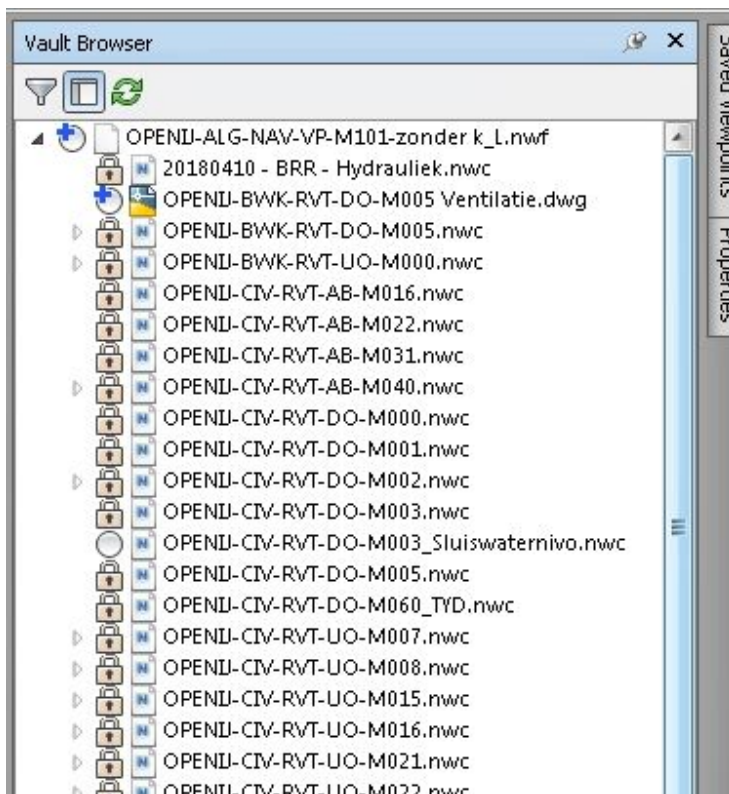
We are managing the NWC-file only in Vault. We've tried to import the NWF-file, but having problems adding NWF-files with materials (written before)



Vault Tab Navisworks Manage

We used Vault to manage all updates of the NWC-files (weekly) to setup a new NWF-file and finally make a published file (NWD). This method helped us to manage with the right and latest version of the NWC-models.

With the Vault Browser you have an overview of all linked files from Vault with the latest version. When it's not the latest version, it will show up as a red bullet. Then you have to refresh the latest model.



Vault Browser at Navisworks

Others

We also have CAD data from another supplier software. For this the data must also be stored in Vault. We did this by using the Check in and Check out method with / without Zip files. With this method we still have and keep a grip on the history of the files.

Unique File naming

To prevent us from using (incorrect) duplicate files in references, we must use unique file names. Some users make copies with date and / or versions, but that is not necessary with Vault. After all, it is a database. If you use unique filenames, you prevent incorrect data references.

Versions and Revisions

Each check in of a file gives a new version of the file in Vault. That is not yet a new revision. This is only given with a new status of the file, Life cycles. We use the following Life cycles:

- Work in Process (WIP)
- Shared (Concept)
- Published (Final)
- As Built
- Archive
- Cancelled

The first 3 statuses also interact with revision numbers that are displayed together again in the title block of the drawing. This creates an interaction between Vault and the AutoCAD drawing. This is not possible with Revit drawings. Here we do this manually.

(Just) Numbers



After migration and working with Vault we have now:

- 73 users helped working with Vault
- In totally 40,000 documents
 - o 100 Revit models
 - o 2,000 drawings
 - o 2,900 assemblies
 - o 2,200 PDF's
 - o 16,000 Parts
 - o 16,800 unsorted
- With 247,000 versions
 - o Largest version 8,304
 - o Average version 6.18
- At 1 Terabyte
 - o 14 Gb Revit models (Actual)
 - o 10 Gb Inventor models (Actual)
 - o 10 Gb Civil3D models (Actual)

Subcontractors

Subcontractors do not always have a BIM idea. Some do not even work in 3D yet.

Subcontractors also have obligations to the project regarding BIM. We have laid this down in the contracts that are entered into with the project. They must provide their CAD data in native format and in a format that can be used for multiple purposes. These are the most common formats that can be used with Autodesk software. All data is stored by the BIM coordinator in Vault so these can be used by the CAD users of the design team.

In a few cases, the BIM coordinator will convert the delivered models into most used 3D formats so that the end users do not have to spend time on this and with the guarantee that this is done in the right way.

Conclusion

Lessons learned

BIM Execution Plan

A BIM Execution plan has been started since the start of the project (Tender). Make this plan together with the closely involved parties. They too have an interest in this and can give you a different insight. As the project progressed, the BIM Execution plan has evolved further. New insights, new experiences and new possibilities must be laid down for long-term projects. A BIM Execution plan is never finished during a project. Experiences gained during the project and important to be recorded must be updated in the plan. The plan also sets out the various roles, responsibilities, project basis points, working methods, software to be used, etc. This is very important for good support and clarity to everyone working on the project.

We evaluated the BIM process recently with some participants. The conclusion was that it was an extensive plan, a clear document that describes everything you need. A good reference documents you can rely on.

LL: Start with a BIM scan at the start of the project. Then begin by describing the merging of all outcomes from the BIM scan into a BIM Execution Plan. Update and adjust it further during the current project. Only in this way every user is kept informed of the adjustments and additions. Take each user along in this plan to discuss the differences of opinion to arrive at one outcome.

Revit and Vault

The combination of Revit and Vault isn't very sufficient.

Because we have a lot of large Revit Central file which have to be synchronized with Vault, this has caused a lot of load from the server. Processing all linked Revit models takes a lot of computing time and a lot of data storage. Over time, we have had to increase the network capacity regularly in order to process the data. Because not all models could be processed at the same time, we had to set shifts for syncing the Revit Central Files. The shifts were divided over Monday, Wednesday and Friday. This was the only way to get this processed.

Using a network from one of the participants, it's always hard to get access to that network. You have to arrange special access by using VPN or other ways because of securities. When you don't have this access, you are not able to work on the project outside the Project office.

LL: When you are working with Central files on a Network, think about using Vault or not. Now I will advise projects to work in the Cloud (BIM 360). This gives you more flexibility in working where ever you want. Using BIM 360 you need Autodesk Desktop Connector getting the right flow.

Civil3D and Vault

With the 2016 version of the software, we had some issues get working the right way. This is not only depending on the software. Hardware and users are a main part of a successful use of Civil3D and Vault. It's sometimes very hard getting the users in a more

dissipative way of working with this combination. Specially during the design phase and time schedule.

LL: When users are not able to work with this combination, take more time (and money) getting a specialist onboard and learn how to setup. It's very helpful having Civil3D models, references and its data-links into Vault. There will be less mess!

Inventor and Vault

Inventor and Vault should be the right combination. That's true. But... While we had Assemblies with thousands of parts and subassemblies the network and own hardware weren't always able to handle all this information.

LL: Sufficient Hardware and a good performing Network is the key of success.

Navisworks and Vault

Although we couldn't add the NWF files to Vault in the first place, it is still good to manage the NWC files in Vault. We have regularly placed the NWF files in Vault as Backup via ZIP. By migrating Vault to version 2019 we where able to manage NWF files again.

LL: Try to manage files as much as possible with Vault even though there is not always a right path. Then use a Workaround.

Other supplier software and Vault

Sometimes it is possible to get software from other suppliers linked to Vault via an add-in. You can always save and manage all kinds of files in a simple check-in and check-out method in Vault. It is not always the most efficient way, but it is in any case managed and version controled.

LL: Always look for the possibilities to manage certain software files in Vault. If this is not possible then there is always the last option to simply check in and out.

Tips & Tricks

Start Vault before start Design Phase

- We had some issues during implemented all different file formats and all kinds of software and all kinds of users. This process toke place while 'the train was running'.
- Decide using Vault must be made in the early start of the project. All participants have time to setup the right way to work with.
- Decide which software you would like to have in the Vault. For now, I will advise using Revit Central File in BIM 360 and all other Autodesk integrated software into Vault.
- Get everyone onboard getting used using Vault in their workflow.
- Make a good BIM Execution Plan with a clear description. No procedure document with all kinds of references!

- Look at Cloud possibilities to have more flexibility for your team.
- Make clear agreements for exchanges with CAD files and formats in the contracts with subcontractors. And record exchange and in which format clearly in the BIM Execution plan

How do we get new users instructed?

During the project there are always changes with CAD users. To introduce the new CAD users to Vault, we have arranged the following:

- Take care of an individual training or in a group
- In addition, we have made a number of leaflets to support the most common issues with Vault
- And finally, we continue to support users in their use

With these 3 points we have generally been able to make the users work well with Vault.

Summary

How to setup projects now?

- Start a BIM Scan with the whole Tender team/Design team
- **Make a good BIM Execution Plan with clear descriptions of all processes and work instructions. Do not make a puzzle out of it.**
- Use Vault for all Autodesk integrated software except Revit
- Use BIM 360 to collaborate with Revit models
- Investigate BIM 360 possibilities